two-stage ignition characteristics of *n*-heptane, which involve low and high temperature regimes followed by a branched chain explosion. The optimized reduced model generally agrees well with those of the detailed chemical kinetic model (544 species and 2446 reactions); the computational time of using the former is less 1/1000 that of the latter.

06/00802 Effects of thermal pretreatment in helium on the pyrolysis behaviour of Loy Yang brown coal

Zeng, C. *et al. Fuel*, 2005, 84, (12–13), 1586–1592.

A wire-mesh reactor capable of multi-step heating/holding and minimizing secondary reactions of volatiles was used to investigate the effects of thermal pre-treatment in inert gas on the subsequent rapid pyrolysis behaviour of Loy Yang brown coal. The results indicate that the presence of small amounts (<10 wt%) of moisture in brown coal has little influence on the tar and char yields from the pyrolysis of brown coal at 1000 K s^{-1}. While the hydrogen bonds between the moisture and the O-containing functional groups in the brown coal have little effects on its pyrolysis behaviour, the hydrogen bonds among the O-containing functional groups tend to induce cross-linking reactions to reduce the tar yields. Preheating the brown coal at >250°C leads to reduced tar and increased char yields. However, the characterization of tars using UV-fluorescence spectroscopy indicates that significant decreases in the release of larger aromatic ring systems are only observed after preheating at >380°C for 30 min. The presence of ion-exchangeable cations (e.g. Ca^{2+}) in the brown coal tends to stabilize the carboxylate groups and only preheating at >350°C would result in changes in pyrolysis yields during the subsequent pyrolysis at 1000 K s^{-1}. These results may be explained by considering the formation of cross-links involving peripheral groups at low preheating temperatures and the formation of cross-links involving aromatic ring systems at elevated temperatures.

06/00803 Financial viabilities of husk-fueled steam engines as an energy-saving technology in Thai rice mills

Sookkumnerd, C. *et al. Applied Energy*, 2005, 82, (1), 64–80.

Rice husk generated as a by-product of rice milling process can be utilized as an energy source for rice mills. The advantages of applying the steam engine as a power source for rice mills are discussed. An economic model was developed to find out the internal rate of return, IRR, on the investment in steam engines as an energy-saving technology in Thai rice mills. Based on the technical and economic data presented in this study, rice mills from 45 to 120 t d^{-1} in size are financially feasible for investments in steam engines. The maximum affordable husk prices at the different levels of mill use for various sizes of rice mill were analysed and the economic performance of higher efficiency technology was also tested in this study.

06/00804 Gas-turbine fault diagnostics: a fuzzy-logic approach

Ogaji, S. O. T. *et al. Applied Energy*, 2005, 82, (1), 81–89.

The aim of this investigation is to describe a way of setting up a fuzzy-logic process to achieve diagnoses, based on gas-path measurements, for modern military turbofan engines. Each engine's gas-path components' faults are quantified, taking into account measurement noise, through a non-linear analysis. A simplified version of this theoretical tool is explained by focusing on one engine-component and assuming that only a single fault occurs at a given time. Eventually the concept is generalized to cater for multiple-component fault diagnoses.

06/00805 Lignite–water interactions studied by phase transition-differential scanning calorimetry

Fei, Y. *et al. Fuel*, 2005, 84, (12–13), 1557–1562.

Differential scanning calorimetry measurements have been made over the temperature range 20 to −50°C with a cooling rate of 5°C/min for six raw Victorian lignites, and for some of these lignites after water washing or acid washing. Two small peaks were observed in the region −28 to −36°C, as found by earlier workers, in addition to a major peak at −5±3°C which was assigned to the freezing of free water. Solutions of sodium chloride showed a single peak at about −42°C as well as the main water peak at approximately −20°C. However, water or acid washing the lignites to remove cations gave samples that retained the small peaks in this region with little change in intensity so that an association between the small peaks and cations or dissolved salts is unlikely. Dry samples of the coals showed no peaks, confirming that these small peaks are associated with coal–water interactions and not with the coal structure or the presence of cations.

06/00806 Methods to improve efficiency of four stroke, spark ignition engines at part load

Kutlar, O. A. *et al. Energy Conversion and Management*, 2005, 46, (20), 3202–3220.

The four stroke, spark ignition (SI) engine pressure–volume diagram (p–V) contains two main parts. They are the compression–combustion–expansion (high pressure loop) and the exhaust-intake (low pressure or gas exchange loop) parts. The main reason for efficiency decrease at part load conditions for these types of engines is the flow restriction at the cross sectional area of the intake system by partially closing the throttle valve, which leads to increased pumping losses and to increased low pressure loop area on the p–V diagram. Meanwhile, the poorer combustion quality, i.e. lower combustion speed and cycle to cycle variations, additionally influence these pressure loop areas. In this study, methods for increasing efficiency at part load conditions and their potential for practical use are investigated. The study also includes a review of the vast literature on the solution of this problem. This investigation shows that the potential for increasing the efficiency of SI engines at part load conditions is not yet exhausted. Each method has its own advantages and disadvantages. Among these, the most promising methods to decrease the fuel consumption at part load conditions are stratified charge and variable displacement engines. When used in combination, the other listed methods are more effective than their usage alone.

06/00807 Modelling and simulation of induction motors with inter-turn faults for diagnostics

Arkan, M. *et al. Electric Power Systems Research*, 2005, 75, (1), 57–66.

This paper presents two orthogonal axis models for simulation of three-phase induction motors having asymmetrical windings and inter-turn short circuits on the stator. The first model assumes that each stator phase winding has a different number of turns. To model shorted stator turns, the second model assumes phase *as* has two windings in series, representing the unaffected portion and the shorted portion. It uses the results of the first model to transfer phase *as* to *qd* so that shorted portion is transferred to the *q* axis. Simulations results from the models are in good agreement with other studies and are compared with experiment carried out on a specially wound motor with taps to allow different number of turns to be shorted. The models have been successfully used to study the transient and steady state behaviour of the induction motor with short-circuited turns, and to test stator fault diagnostic algorithms operating in real time.

06/00808 Parametric study of chemical looping combustion for tri-generation of hydrogen, heat, and electrical power with CO_2 capture

Wolf, J. and Yan, J. *International Journal of Energy Research*, 2005, 29, (8), 739–753.

In this article, a novel cycle configuration has been studied, termed the extended chemical looping combustion integrated in a steam-injected gas turbine cycle. The products of this system are hydrogen, heat, and electrical power. Furthermore, the system inherently separates the CO_2 and hydrogen that is produced during the combustion. The core process is an extended chemical looping combustion (exCLC) process which is based on classical chemical looping combustion (CLC). In classical CLC, a solid oxygen carrier circulates between two fluidized bed reactors and transports oxygen from the combustion air to the fuel; thus, the fuel is not mixed with air and an inherent CO_2 separation occurs. In exCLC the oxygen carrier circulates along with a carbon carrier between three fluidized bed reactors, one to oxidize the oxygen carrier, one to produces and separate the hydrogen, and one to regenerate the carbon carrier. The impacts of process parameters, such as flowrates and temperatures have been studied on the efficiencies of producing electrical power, hydrogen, and district heating and on the degree of capturing CO_2. The result shows that this process has the potential to achieve a thermal efficiency of 54% while 96% of the CO_2 is captured and compressed to 110 bar.

06/00809 Performance optimization of a two-stage semiconductor thermoelectric-generator

Chen, L. *et al. Applied Energy*, 2005, 82, (4), 300–312.

A model of a two-stage semiconductor thermoelectric-generator with external heat-transfer is built. Performance of the generator, assuming Newton's heat-transfer law applies, is analysed using a combination of finite-time thermodynamics and non-equilibrium thermodynamics. The analytical equations about the power output versus the working electrical current, and the thermal efficiency versus working electrical-current are derived. For a fixed total heat-transfer surface-area for two heat exchangers, the ratio of heat-transfer surface-area of the high-temperature side heat-exchanger to the total heat-transfer surface-area of the heat-exchangers is optimized for maximizing the power output and the thermal efficiency of the thermoelectric-generator. For a fixed total number of thermoelectric elements, the ratio of number of thermoelectric elements of the top stage to the total number of thermoelectric elements is also optimized for maximizing both the power output and the thermal efficiency of the thermoelectric-generator. The effects of design factors on the performance are analysed.

06/00810 Rotor flux oriented control of a symmetrical six-phase induction machine

Vukosavic, S. N. *et al. Electric Power Systems Research*, 2005, 75, (2–3), 142–152.